WHAT IS CLAIMED

1. A range-extending communication architecture for an asymmetrical digital subscriber line (ADSL) communication system having an upstream site adapted to be coupled to an upstream ADSL communication device that provides access to one or more digital communication resources of a telecommunication network, and a downstream site having a downstream ADSL communication device adapted to interface ADSL communication signals with customer premises equipment, comprising:

a communication link coupled between said upstream site and said downstream site;

an upstream site transceiver that is operative to process a downstream ADSL signal provided by said upstream ADSL communication device with a downstream plain old telephone system (POTS) signal into a composite downstream modulated signal for transmission over said communication link to said downstream site; and

a downstream site transceiver that is operative to receive said composite downstream modulated signal transmitted over said communication link from said upstream site transceiver, and to output said downstream POTS signal for application to a downstream POTS device, and to output said downstream ADSL signal for application to said downstream ADSL communication device.

2. The range-extending communication architecture according to claim 1, wherein said upstream ADSL communication device is coupled to said upstream site transceiver over a first, relatively short haul communication loop, that is capable of supporting digital communications at a relatively high data rate, in excess of the data rate capable of being supported by said communication link.

3. The range-extending communication architecture according to claim 1, wherein said upstream ADSL communication device is associated with a digital subscriber line access multiplexer (DSLAM).

4. The range-extending communication architecture according to claim 1, wherein said communication link comprises a single twisted conductive pair of the type employed for symmetric digital subscriber loop (SDSL) communications.

5. The range-extending communication architecture according to claim 1, wherein said single twisted conductive pair has a length on the order of twenty kilofeet to twenty-five kilofeet.

6. The range-extending communication architecture according to claim 1, wherein said communication link comprises a long haul loop of the type employed for

symmetric digital subscriber loop (SDSL) communications, and wherein said upstream transceiver is adapted to transmit said composite downstream digital signal over said communication link to said downstream site transceiver using trellis coded pulse amplitude modulation (TC-PAM).

7. The range-extending communication architecture according to claim 1, wherein

said downstream site transceiver is operative to process an upstream ADSL signal provided by said downstream ADSL communication device with an upstream POTS signal provided by said downstream POTS device into a composite upstream modulated signal for transmission over said communication link to said upstream site transceiver; and

said upstream site transceiver is operative to receive said composite upstream modulated signal transmitted over said communication link from said downstream site transceiver, and to output said upstream POTS signal for delivery to an upstream POTS device, and to output said upstream ADSL signal for application to said upstream ADSL communication device.

8. The range-extending communication architecture according to claim 1, wherein said downstream ADSL communication device is coupled to said downstream site transceiver over a second, relatively short haul

communication loop, that is capable of supporting digital communications at a relatively high data rate, in excess of the data rate capable of being supported by said communication link.

9. The range-extending communication architecture according to claim 1, wherein said upstream site transceiver includes an ADSL path having an asynchronous transfer mode (ATM) processor, that is adapted to controllably insert idle ATM cells in a serial transport path for ATM cells of a downstream ADSL channel for transmission over said communication link, at a downstream idle ATM cell data rate that compensates for timing differences between said upstream ADSL communication device and a downstream data transmission rate of said upstream site transceiver.

10. The range-extending communication architecture according to claim 9, wherein said ATM processor of said upstream site transceiver comprises a multi-ATM cell-deep, first-in, first-out buffer (FIFO) through which ATM cells of said downstream ADSL channel are controllably serially transferred to provide for said insertion of idle ATM cells.

11. The range-extending communication architecture according to claim 10, wherein said multi-ATM cell-deep FIFO has a depth of two ATM cells.

12. The range-extending communication architecture according to claim 10, wherein said ATM processor of said upstream site transceiver is operative to controllably insert idle ATM cells into said downstream ADSL channel at a rate of 8 Kbps.

13. The range-extending communication architecture according to claim 9, wherein said upstream site transceiver includes a POTS path that is adapted to digitally encode a downstream POTS signal into a downstream digital POTS channel for combination with said downstream ADSL channel and trellis coded pulse amplitude modulation (TC-PAM) based transmission by said TC-PAM modulator over said communication link.

14. The range-extending communication architecture according to claim 1, wherein said downstream site transceiver includes an ADSL path having an asynchronous transfer mode (ATM) processor, that is adapted to controllably insert additional idle ATM cells in a serial transport path for received ATM cells, at a downstream idle ATM cell data rate that enables said downstream ADSL communication device to train on multi-bit block boundaries of ATM cell data.

15. The range-extending communication architecture according to claim 14, wherein said ATM processor of said downstream site transceiver includes a multi-ATM cell-

deep, first-in, first-out buffer (FIFO) through which ATM cells of said downstream ADSL channel received from said communication link are controllably serially transferred to provide for said insertion of idle ATM cells.

16. The range-extending communication architecture according to claim 14, wherein said ATM processor of said downstream site transceiver is operative to controllably insert idle ATM cells into said downstream ADSL channel at a rate of 24 Kbps.

17. The range-extending communication architecture according to claim 7, wherein said downstream site transceiver includes an ADSL path having an asynchronous transfer mode (ATM) processor, that is adapted to controllably insert idle ATM cells in a serial transport path for ATM cells of an upstream ADSL channel for transmission over said communication link, at an upstream idle ATM cell data rate that compensates for timing differences between said upstream ADSL communication device and an upstream data transmission rate of said upstream site transceiver.

18. The range-extending communication architecture according to claim 17, wherein said ATM processor of said downstream site transceiver comprises a multi-ATM cell-deep, first-in, first-out buffer (FIFO) through which ATM cells of said upstream ADSL channel are controllably

serially transferred to provide for said insertion of idle ATM cells.

19. The range-extending communication architecture according to claim 18, wherein said multi-ATM cell-deep FIFO has a depth of two ATM cells.

20. The range-extending communication architecture according to claim 18, wherein said ATM processor of said downstream site transceiver is operative to controllably insert idle ATM cells into said upstream ADSL channel at a rate of 8 Kbps.

21. The range-extending communication architecture according to claim 17, wherein said downstream site transceiver includes a POTS path that is adapted to digitally encode an upstream POTS signal into an upstream digital POTS channel for combination with said upstream ADSL channel and transmission by said TC-PAM modulator over said communication link to said upstream site transceiver.

22. The range-extending communication architecture according to claim 7, wherein said upstream site transceiver includes an ADSL path having an asynchronous transfer mode (ATM) processor, that is adapted to controllably insert additional idle ATM cells in a serial transport path for received ATM cells, at an upstream

idle ATM cell data rate that enables said upstream ADSL communication device to train on multi-bit block boundaries of ATM cell data.

23. The range-extending communication architecture according to claim 22, wherein said ATM processor of said upstream site transceiver includes a multi-ATM cell-deep, first-in, first-out buffer (FIFO) through which ATM cells of said upstream ADSL channel received from said communication link are controllably serially transferred to provide for said insertion of idle ATM cells.

24. The range-extending communication architecture according to claim 22, wherein said ATM processor of said upstream site transceiver is operative to controllably insert idle ATM cells into said upstream ADSL channel at a rate of 24 Kbps.

25. A method of extending the range of an asymmetrical digital subscriber line (ADSL) communication system having an upstream site, that is adapted to be coupled to an upstream ADSL communication device providing access to one or more communication resources of a telecommunication network, and a downstream site having a downstream ADSL communication device that is adapted to interface ADSL communication signals with customer premises equipment, said method comprising the steps of:

(a) at said upstream site, processing a downstream ADSL signal provided by said upstream ADSL communication device with a downstream plain old telephone system (POTS) signal into a composite downstream modulated signal, and transmitting said composite downstream modulated signal over a communication link to said downstream site; and

(b) at said downstream site, receiving said composite downstream modulated signal that has been transmitted over said communication link from said upstream site in step (a), extracting therefrom said downstream POTS signal for delivery to a downstream POTS device, and said downstream ADSL signal for delivery to said downstream ADSL communication device.

26. The method according to claim 25, wherein said upstream ADSL communication device comprises a digital subscriber line access multiplexer (DSLAM).

27. The method according to claim 25, wherein said communication link comprises a long haul loop of the type employed for symmetric digital subscriber loop (SDSL) communications, and wherein step (a) comprises transmitting said composite downstream modulated signal over said communication link to said downstream site transceiver using trellis coded pulse amplitude modulation (TC-PAM).

28. The method according to claim 25, further including the steps of:

(c) at said downstream site, processing an upstream ADSL signal provided by said downstream ADSL communication device with an upstream POTS signal provided by said downstream POTS device into a composite upstream modulated signal, and transmitting said composite upstream modulated signal over said communication link to said upstream site transceiver; and

(d) at said upstream site, receiving said composite upstream modulated signal transmitted over said communication link from said downstream site in step (c), and coupling said upstream POTS signal to an upstream POTS device, and coupling said upstream ADSL signal to said upstream ADSL communication device.

29. The method according to claim 25, wherein step (a) further includes controllably inserting idle asynchronous transfer mode (ATM) cells in a serial transport path for ATM cells of a downstream ADSL channel for transmission over said communication link, at a downstream idle ATM cell data rate that compensates for timing differences between said upstream ADSL communication device and a downstream data transmission rate employed in step (a).

30. The method according to claim 29, wherein step (a) includes controllably coupling said ATM cells of said

downstream ADSL channel through a multi-ATM cell-deep, first-in, first-out buffer (FIFO) to provide for said insertion of idle ATM cells.

31. The method according to claim 30, wherein said multi-ATM cell-deep FIFO has a depth of two ATM cells.

32. The method according to claim 30, wherein step (a) comprises controllably inserting idle ATM cells into said downstream ADSL channel at a rate of 8 Kbps.

33. The method according to claim 25, wherein step (b) further includes controllably inserting idle asynchronous transfer mode (ATM) cells in a serial transport path for received ATM cells of a downstream ADSL channel, at a downstream idle ATM cell data rate that enables said downstream ADSL communication device to train on multi-bit block boundaries of ATM cell data.

34. The method according to claim 33, wherein step (b) comprises controllably inserting idle ATM cells into said downstream ADSL channel at a rate of 24 Kbps.

35. The method according to claim 28, wherein step (c) includes controllably inserting idle ATM cells in a serial transport path for ATM cells of an upstream ADSL channel, at an upstream idle ATM cell data rate that compensates for timing differences between said upstream

ADSL communication device and an upstream data transmission rate of step (c).

36. The method according to claim 35, wherein step (d) includes controllably inserting additional idle ATM cells in a serial transport path for received ATM cells, at an upstream idle ATM cell data rate that enables said upstream ADSL communication device to train on multi-bit block boundaries of ATM cell data.

37. An asymmetrical digital subscriber line (ADSL) communication system comprising:

an upstream site transceiver adapted to process a downstream ADSL signal provided by an upstream ADSL communication device and a downstream plain old telephone system (POTS) signal into a composite downstream modulated signal for transmission over a communication link from an upstream site thereof; and

a downstream site transceiver, coupled a downstream site of said communication link that is remote with respect to said upstream site, and being operative to receive said composite downstream modulated signal transmitted over said communication link from said upstream site transceiver, and to extract from said composite downstream modulated signal said downstream POTS signal for delivery to a downstream POTS device, and said downstream ADSL signal for delivery to said downstream ADSL communication device.

38. The ADSL communication system according to claim 37, wherein said upstream site transceiver is coupled over a first, relatively short haul communication loop to said ADSL communication device, said ADSL communication device being capable of conducting ADSL communications over said first, relatively short haul communication loop at a relatively high data rate that conforms with a prescribed communication standard, and exceeds a reduced data rate at which said communication link conforms with said prescribed communication standard, and wherein said ADSL communication device is configured to conduct downstream ADSL communications over said first, relatively short haul loop at a downstream communication data rate that is no greater than said reduced data rate.

39. The ADSL communication system according to claim 38, wherein said reduced data rate is derived in accordance with measurements conducted on said communication link, based on transmissions between said upstream and downstream site transceivers.

40. The ADSL communication system according to claim 38, wherein said downstream communication data rate is less than said reduced data rate by an amount that accommodates the data rate of an auxiliary digital plain old telephone system (POTS) channel.

41. A range-extending communication architecture for an asymmetrical digital subscriber line (ADSL) communication system having an upstream site adapted to be coupled to an upstream ADSL communication device that provides access to one or more digital communication resources of a telecommunication network, and a downstream site having a downstream ADSL communication device adapted to interface ADSL communication signals with customer premises equipment, comprising:

a symmetric digital subscriber line (SDS) communication link coupled between said upstream site and said downstream site;

an upstream site transceiver that is operative to process a downstream ADSL signal provided by said upstream ADSL communication device for transmission in a downstream modulated signal over said SDSL communication link to said downstream site; and

a downstream site transceiver that is operative to receive said downstream modulated signal transmitted over said SDSL communication link from said upstream site transceiver, and to output said downstream ADSL signal for application to said downstream ADSL communication device.

42. The range-extending communication architecture according to claim 41, wherein said upstream site transceiver is coupled over a first, relatively short

haul communication loop to said upstream ADSL communication device, said upstream ADSL communication device being capable of conducting ADSL communications over said first, relatively short haul communication loop at a relatively high data rate that conforms with a prescribed communication standard, and exceeds a reduced data rate at which said SDSL communication link conforms with said prescribed communication standard, and wherein said upstream ADSL communication device is configured to conduct downstream ADSL communications over said first, relatively short haul loop at a downstream communication data rate that is no greater than said reduced data rate.

43. The range-extending communication architecture according to claim 42, wherein said reduced data rate is derived in accordance with measurements conducted on said SDSL communication link, based on transmissions between said upstream and downstream site transceivers.

44. The range-extending communication architecture according to claim 43, wherein said downstream communication data rate is less than said reduced data rate by an amount that accommodates the data rate for an auxiliary plain old telephone system (POTS) signal.

45. The range-extending communication architecture according to claim 41, wherein said SDSL communication link comprises a long haul loop of the type employed for

SDSL communications, and wherein said upstream transceiver is adapted to transmit said modulated signal over said SDSL communication link to said downstream site transceiver using trellis coded pulse amplitude modulation (TC-PAM).